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EXAMINER

WERNER, BRIAN P

ART UNIT

PAPER NUMBER

2621

DATE MAILED: 07/10/2003

12

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/418,441

Applicant(s)

NAKAMURA ET AL.

Examiner

Brian P. Werner

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 April 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☒ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 14-32 is/are pending in the application.
- 4a) Of the above claim(s) 16, 17 and 24-29 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14, 15, 18-23 and 30-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 21 January 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All   b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Election/Restrictions*

1. Claims 16, 17 and 24-29 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 11.

### *Response to Amendment*

2. The amendment and response received on January 21, 2003 has been entered. In the amendment, original claims 1-13 were cancelled in favor of new claims 14-32, of which claims 16, 17 and 24-29 are withdrawn from further consideration. ***Claims 14, 15, 18-23, and 30-32 are examined herein.*** The substitute specification has been entered, with pages 1-36 of the substitute specification now replacing pages 1-33 of the original specification. Applicant's provision of a marked-up copy of the substitute specification and assertion that now new matter has been entered is acknowledged (i.e., on page 10 of the response).

### *Drawings*

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on January 21, 2003 have been approved. A proper drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The correction to the drawings will not be held in abeyance.

### ***Specification***

4. The abstract of the disclosure provided with the substitute specification is objected to because it is not in the form of a single paragraph, and it includes a brackets at line 5 (i.e., “[Means for Achieving the Object]”) that seem to indicate a deletion. A corrected, clean copy in a single paragraph is required. See MPEP § 608.01(b).

5. The substitute specification is objected to because of the following:

There does not appear to be a “summary” of the invention, the “brief description of the drawings” is placed at the end of the specification (i.e., instead of before the detailed description where it should be), there is a list of reference numerals following the claims (i.e., the specification should “conclude” with the claims, not a list of reference numerals), and it is not clear where the “detailed description” starts. Further, the substitute specification, at page 12, refers to “FIG. 25”. There is no figure 25. It will be assumed that figure 5 is being referred to. The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant’s use.

### **Arrangement of the Specification**

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase “Not Applicable” should follow the section heading:

(a) TITLE OF THE INVENTION.

(b) CROSS-REFERENCE TO RELATED APPLICATIONS.

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- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC (See 37 CFR 1.52(e)(5) and MPEP 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text are permitted to be submitted on compact discs.) or REFERENCE TO A "MICROFICHE APPENDIX" (See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.)
- (e) BACKGROUND OF THE INVENTION.
  - (1) Field of the Invention.
  - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (f) BRIEF SUMMARY OF THE INVENTION.
- (g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
- (h) DETAILED DESCRIPTION OF THE INVENTION.
- (i) CLAIM OR CLAIMS (commencing on a separate sheet).
- (j) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
- (k) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

Appropriate correction and conformity of U.S. practice is required.

6. The following quotations of 37 CFR § 1.75(a) is the basis of objection:

(a) The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

7. Claims 14, 17, 23, 30 and 31 are objected to under 37 CFR § 1.75(a) as failing to particularly point out and distinctly claim the subject matter which the applicant regards as his invention or discovery.

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Claim 30, second to last line, recites "followed real time". The meaning of this is unclear. It will be assumed that "followed in real time" was intended. Claims 14 and 15 recite the same limitation, and are objected to for the same reason.

Claim 30, the meaning of the entire limitation of "points of the object is detected at a speed at which three-dimensional information are followed real time within a period of time corresponding to the frame of a video signal" is unclear. What does this mean? What is meant by "followed [in] real time"? Is something actually followed? What video signal? A "video signal" is not mentioned in the claim up to that point. According to the examiner's reading and interpretation of the specification as a whole, the limitation will be interpreted in accordance with specification page 3, which states: "detection of three-dimensional information pertaining to the object within a period of time corresponding to the frame of a video signal". In other words, a period of time corresponding to one frame of image acquisition by the image pickup section is required to produce three dimensional information regarding the object. Claims 14 and 15 recite the same limitation, and are objected to for the same reason.

Claim 31, line 3, the "law diode" should be a "laser diode" according to line 5 of the same claim. Further, line 5 of the claim requires a "modulator capable of modulating ...". The term "capable of" does not positively define a claim limitation in US practice. Rule 75(a) requires the applicant to particularly point out and distinctly claim the subject matter that he regards as the invention. Therefore, claims should define an invention by what it "is", and not by what it "can be" or is otherwise "capable of" doing. These terms, while not indefinite, do not positively define or further limit the invention. Therefore, in

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accordance with the plain meaning of "can be" and "capable of", so long as a prior art reference "can" or is "capable" of performed the recited function (e.g., if properly adjusted, modified or programmed), then the claim limitation is met by the reference.

Claim 14, at line 5, recites, "acquisition of an image pick-up gain having faster changing rate than a changing rate of the intensity of the illumination lights". The meaning of this is unclear. First, an "acquisition of an image pick-up gain" appears to be the acquiring of a gain. This is not what is disclosed. According to the original disclosure, a gain is not acquired. Rather, an image is acquired at a given image pickup gain. Further, this limitation makes it seem as though the gain is changing, but it is not. The gain during image acquisition remains fixed for this embodiment (e.g., " $g=g_0$ " at specification page 7, top line). Given that this claim seems to correspond to figure 2, it appears that this limitation is directed to the acquiring of an image during a very short period of time ( $\Delta t$  in figure 2) with respect to the changing illumination ("I" in figure 2). Therefore, the examiner will interpret the limitation accordingly. NOTE: Claim 15 recites a similar limitation at lines 4-5, which is better stated and more clear.

Claim 23 recites exactly the same limitations as claim 21, while both depend directly from claim 14. It appears that claim 23 should depend from claim 15, and this will be assumed for examination purposes.

### ***Claim Construction***

8. The examiner shall interpret the claimed terminology listed below as follows:

Claimed Terminology	Interpretation
"calculates a <b><i>distance between respective points</i></b> of the object"; e.g., at claim 30, line 7.	The claimed "distance" is not a distance between points on the object with respect to one another per se., but actually a distance "between the object and the laser", or light source, as described at specification page 1, bottom line. Thus, the claimed terminology shall be interpreted as: calculates a <b><i>distance between respective points</i></b> of the object <b><i>and the light source (or projection section, laser, etc. depending upon the claim.)</i></b> .
"capable of"; e.g., claim 31, line 5.	Plain Meaning: Having capacity or ability; able.
"period of time corresponding to the frame of a video signal"; e.g., at claim 30, line 11.  "real time"; e.g., at claim 30, line 11.  "points of the object is detected at a speed at which three-dimensional information are followed real time within a period of time corresponding to the frame of a video signal"; e.g., claim 30, lines 10-12.	"T" in figures 2-4; broadly, one complete cycle of image acquisition.  A normal video frame rate; see interpretation immediately below.  "detection of three-dimensional information pertaining to the object within a period of time corresponding to the frame of a video signal" as described at specification page 3.  "image pick-up element 6 is activated twice as fast as it is activated in normal times, to thereby acquire a video signal pertaining to two images" at specification page 18.  Thus, in the examiner's own words, the limitation will be interpreted in accordance with the specification as follows:  Points on the object are detected at a speed (or rate) at which 3D information is output from the image pick-up device in real time, the 3D information being output within a period of time of one normal frame of the image pickup device (i.e., during normal image acquisition for which it was designed).
"acquisition of an image pick-up gain having faster changing rate than a changing rate of the intensity of the illumination lights"; e.g., claim 14, line 5.	The rate that the image pickup gain changes from off to one is faster than a rate that the light source changes from off to on.



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<p>“acquisition of the given level of a image pick-up gain with a shorter changing cycle than a changing cycle of the intensity of the illumination”; e.g., claim 15, line 5.</p>	<p>The cycle of picking up images is shorter that the cycle of illumination changes.</p>
<p>“two illumination lights”; e.g., claim 14, line 3.</p> <p>“an intensity that varies with time”; e.g., claim 14, line 3.</p> <p>“image pick-up element having storage effect”; e.g., claim 14, line 7.</p>	<p>Two separate illuminations of the object, i.e., at different periods of time, from the same illumination source as depicted in figures 2 and 8.</p> <p>The light is neither constantly one nor constantly off; i.e., the illumination from the light source changes, and any rate, with time.</p> <p>Having the ability to store images in a memory, such as depicted by memories 1 and 2 in figure 11.</p>

### ***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 14, 18, 20, 21 and 30-32 are rejected under 35 U.S.C. 102(b) as being anticipated by Ogawa (US 5,694,203 A – art of record).

Regarding **independent claim 30**, Ogawa discloses:

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a projections section (figure 1, numerals 1-4) projecting illumination of a given intensity (the light is "pulse-modulated" at column 3, line 48; thus, the light has the intensity of the pulse peak) on an object (figure 1, numeral 12);

an image pickup section (figure 1, numerals 5, 6 and 8) acquiring an image of the object (i.e., via lens 5 in figure 1) with a given image pickup gain (the image intensifier at figure 1, numeral 6, has a given light amplification gain as described at column 6, lines 34-36);

a storage section temporarily storing the image (figure 3, numeral S2; "frame (page) memory" at column 5, line 21);

a processing section calculating distance between points on an object (figure 1, "A" and "B" on object 12; "whole distance image" at column 5, line 52) based on intensity information ("maximum value is stored in the frame memory" at column 5, line 35; the intensity of the reflected light is captured, and used to determine distance);

the distance between points is detected in real time ("real time" at column 1, line 9 and column 4, line 19; "high speed" at column 1, line 65-66) within a period corresponding to the frame of a video signal ("the contents of ZBU is a distance image" at column 5, line 39; the contents of ZBUF, which corresponds to one video frame of distance data, "are obtained per one cyclical period T" at line 43; the period T is the frame rate; Also, given that the normal frame rate for a CCD camera, such as the CCD at figure 1, numeral 8, is 30 frames per second; this is one frame for every .03 seconds; whereas the image intensifier at numeral 6 in figure 1 is gated at several nanoseconds

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as described at column 6, line 40; thus, the CCD is capturing several distance images at a rate of several nanoseconds apart for every frame of the normal frame rate).

Regarding **dependent claim 31**, Ogawa discloses modulating (figure 1, numerals 1 and 2) a light emitting diode (figure 1, numeral 3).

Regarding **dependent claim 32**, Ogawa discloses means for producing an optical image of reflected light (figure 1, numeral 5), an image pickup element outputting a video signal (figure 1, numeral 8), and an image intensifier between the two (figure 1, numeral 6) with a gating operation which controls gain (figure 1, GTS).

Regarding **independent claim 14**, Ogawa discloses:

Illuminating an object sequentially with two illumination lights ("CLK" at figure 2; there is an illumination each time the CLK is pulsed), at least one of which having an intensity that varies with time (each clock pulse varies with time; a pulse by its very nature varies with time from zero-to-high and back to zero);

acquiring an image of the object illuminated by the two lights (i.e., via lens 5 in figure 1) by acquisition of a image pick-up gain having faster changing rate than a changing rate of the intensity of the illumination lights (looking at figure 2, the GTS signal corresponds to the gate controlling the image intensifier numeral 6 in figure 1; the signal RWDA corresponds to the illumination of the light source; a comparison of GTS and RWDA reveals that the rate of change of GTS is much greater than the rate of change of RWDA; i.e., the slope of GTS is almost infinite, whereas the slope of RWDA is gentle in comparison), where the image of the object is acquired a plurality of times

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by an image pick-up element (five times as indicated in figure 2) having storage effect (the images are stored as indicated in figure 3; e.g., the "ZBUF" is a storage buffer):

detecting a distance between points of the object on the basis of the image obtained (figure 1, "A" and "B" on object 12; "whole distance image" at column 5, line 52); wherein

the distance between respective points is detected in real time ("real time" at column 1, line 9 and column 4, line 19; "high speed" at column 1, line 65-66) within a period corresponding to the frame of a video signal ("the contents of ZBU is a distance image" at column 5, line 39; the contents of ZBUF, which corresponds to one video frame of distance data, "are obtained per one cyclical period T" at line 43; the period T is the frame rate; Also, given that the normal frame rate for a CCD camera, such as the CCD at figure 1, numeral 8, is 30 frames per second; this is one frame for every .03 seconds; whereas the image intensifier at numeral 6 in figure 1 is gated at several nanoseconds as described at column 6, line 40; thus, the CCD is capturing several distance images at a rate of several nanoseconds apart for every frame of the normal frame rate).

Regarding **dependent claim 18**,

first and second optical images illuminated by first and second light sources are formed (figure 2, first and second images are detected at GTS pulses 3 and 5);

the image obtained alternately with a single image pick-up gain over a given period of time (the image pickup is either on or off as indicated by the GTS pulses; i.e., the gain is a single gain when the image acquisition device is on);

the first and second images are stored (figure 3; the images are stored); and the distance between respective points are detected each by the first and second images are detected sequentially for each frame of the video signal (the process is repeated for each cycle "T" as indicated in figure 2).

Regarding **dependent claims 20 and 21**, the plurality of light pulses are pulsed, and thus each increase to a constant level for a period of time, and then decrease to zero).

11. Claims 15, 19, 22 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Stern et al. (US 5,16,259 A).

Regarding **independent claim 15**, Stern discloses:

Illuminating an object sequentially with two illumination lights ("succession of short pulses" at column 5, line 50), at least one of which having an intensity that varies with time (each clock pulse varies with time; a pulse by its very nature varies with time from zero-to-high and back to zero; e.g., the pulse "to target" is depicted in figure 1);

acquiring an image of the object (figure 1, numeral 2) illuminated by the two lights ("receiver 20" at column 5, line 52 and as depicted in figure 1) by acquisition of the given level of a image pick-up gain with shorter changing cycle than a changing cycle of the intensity of the illumination light (the cycle of the gain changes numerous times for each change in illumination; e.g., figure 9 depicts four cycles of  $g1/g2/c1$  during time period  $t2$  for only one cycle of illumination), where the image of the object is acquired a plurality of times by an image pick-up element (e.g., four times in figure 9, as described

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above) having storage effect (the images are stored in the "range processor" if numeral 31, at figure 1):

detecting a distance between points of the object on the basis of the image obtained ("distance or range to the corresponding surface points of the target" at column 3, line 33); wherein

the distance between respective points is detected in real time within a period corresponding to the frame of a video signal (e.g., as depicted in figures 6 and 7; the claim makes no requirements regarding a "frame"; thus, given that each measurement of distance in the Stern reference happens at  $t_T$ , and the image of reflected light is captured by the detector as shown by figure 7, then the process of generating 3D information happens in real time within a period of one frame).

Regarding **dependent claim 19**,

first and second optical images illuminated by first and second light sources are formed (one image is formed each time the pick-up device is gated, as depicted in figure 9);

the image obtained alternately with a single image pick-up gain over a given period of time (each time an image is picked up, it is acquired at a single gain in accordance with the gain function; e.g., the image acquired at  $t_T$  in figure 2A is at a single point on the gain function, and is thus at a single gain);

the first and second images are stored (figure 1, numeral 24); and

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the distance between respective points are detected each by the first and second images are detected sequentially for each frame of the video signal ("distance or range to the corresponding surface points of the target" at column 3, line 33).

Regarding **dependent claims 20 and 21**, the plurality of light pulses are pulsed, and thus each increase to a constant level for a period of time, and then decrease to zero).

### ***Response to Arguments***

12. Each of applicant's remarks and arguments (in as much as they still applied to the grounds of rejection advanced herein) contained on amendment pages 10-15 will be addressed below.

#### **Specification:**

Summary of Remarks: The new specification overcomes the previous objections.

Examiner's Response: Examiner disagrees. The specification remains objected to for the reasons advanced above.

#### **Prior Art Rejections:**

Summary of Remarks: "... Ogawa can not detect the distance in real time ..." (response page 10).

Examiner's Response: Examiner disagrees. Regardless the number of images required, the Ogawa system provides a "high speed distance camera" (Ogawa, column 1, line 65) that forms a distance image "in a real time" (Ogawa, column 1, line 10).

Summary of Remarks: In Ogawa, "the distance can only be detected in discrete values" and "using the present invention, the distance can be detected sequentially" (response page 10).

Examiner's Response: This argument does not correspond to claimed subject matter. In like manner, the arguments presented at response pages 11-15 are generalities about the disclosed invention vs. the prior art, without addressing specific claimed elements and limitations in relation to the prior art. Given that the examiner has rewritten the rejections of the prior art of record in accordance with the newly presented claims, no response to these generalities is merited. Instead, the examiner points to the rejections above as his response. In order to expedite prosecution, the examiner suggest that future remarks be directed to specific claimed elements or limitations.

### ***Suggestions***

13. The following limitations or equivalents are suggested:

Illuminating an object sequentially with two illumination<sup>2</sup> lights, one of which has a linearly<sup>3</sup> varying intensity and the other of which has a constant<sup>4</sup> intensity;

acquiring a video frame of the object<sup>5</sup> during the illumination cycle, wherein for each video frame, the object is acquired once during each illumination using an image<sup>6</sup>



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pick-up having a same level of a image pick-up gain, where the gain has a shorter  
changing cycle than a changing cycle of the intensity of the illumination light;

detecting a distance between points of the object on the basis of the image  
obtained; wherein

the distance between respective points is detected in real time within a period  
corresponding to the video frame.

### **Conclusion**

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


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15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Werner whose telephone number is 703-306-3037. The examiner can normally be reached on M-F, 8:00 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo H. Boudreau can be reached on 703-305-4706. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4750.

Brian Werner  
Patent Examiner  
July 8, 2003



BRIAN WERNER  
PRIMARY EXAMINER